



UNITED STATES ENVIRONMENTAL PROTECTION  
AGENCY

OFFICE OF CHEMICAL SAFETY  
AND POLLUTION PREVENTION

**PC Code:** 030564  
**DP Barcode:** 440803  
**Date:** May 10, 2018

**MEMORANDUM**

**SUBJECT:** MCPA 2-EHE – review of laboratory volatility study

**TO:** Julie Javier, Chemical Review Manager  
Ricardo Jones, Team Leader  
Neil Anderson, Branch Chief  
Risk Management and Implementation Branch 1  
Pesticide Re-Evaluation Division (7508P)

**FROM:** Iwona L. Maher, Chemist  
Environmental Risk Branch 6  
Environmental Fate and Effects Division (7507P)

**THROUGH:** Monica Wait, RAPL  
Brian Anderson, Acting Branch Chief  
Environmental Risk Branch 6  
Environmental Fate and Effects Division (7507P)

The MCPA Task Force Three submitted a laboratory volatility from soil study that was required through the registration review data call-in. The Environmental Fate and Effects Division (EFED) reviewed the submitted study and deemed it unacceptable/upgradable; the classification can be upgraded upon receipt of additional data validating the study. Please refer to the attached data evaluation record (DER) for additional details.

| Guideline   | Study Title                 | MRID     | Classification <sup>1</sup> | Comments  |
|---|-----------------------------|----------|-----------------------------|---|
| 835.1410  | Laboratory Volatility Study | 50295201 | Unacceptable / Upgradable   | This study is unacceptable, but upgradable upon receipt of instrument calibration data, storage information, method LOQ and LOD, and other data outlined in the attached DER. |
| <sup>1</sup> OPPIN Classifications: Acceptable/Guideline; Acceptable/Non-Guideline; Cited; Confirmatory; Decision Deferred; Extraneous submission; In Review; No Decision; Partially Acceptable; Supplemental: Unacceptable/Guideline; Unacceptable/Non-Guideline; Upgradeable. |                             |          |                             |   |

**Laboratory volatility of MCPA 2-EHE (MCPA 2-ethyl hexyl ester)**

**Report:** MRID 50295201. Clark, B. 2017. Lab Volatility of <sup>14</sup>C-MCPA 2-EHE from Soil. Unpublished study sponsored by MCPA Task Force Three, Raleigh, North Carolina and performed by Analytical Bio-Chemistry Laboratories, Inc., a subsidiary of EAG, Inc., Columbia, Missouri. EAG Study No. 83842. Study completion May 31, 2017.

**Document No.:** MRID 50295201

**Guideline:** OCSPP 835.1410

**Statements:** The study was conducted in compliance with USEPA Good Laboratory Practice Standards (p. 3). Signed and dated Data Confidentiality, GLP Compliance, and Quality Assurance statements were provided (pp. 2-4). No Authenticity Certification statement was provided.

**Classification:** This study is classified unacceptable/upgradable. Volatile flux rates are reported for total organic volatiles; a volatile flux rate for MCPA 2-EHE, MCPA, and degradate(s) was not calculated/provided. No information is provided on instrument calibration or storage stability of test materials. LODs and LOQs are not provided. It appears that instead of the end use product of MCPA 2-EHE, the active ingredient was tested.

To validate the study, the missing method information and percent recoveries of MCPA, MCPA 2-EHE, and degradates (tabular data and raw data) for all media are requested. In addition, data proving no reduction in volatility due to adsorption to soil and soil texture during the testing are required. The reviewer could not assess if there was reduction in volatility due to sorption to soil since a testing of a sterilized soil was not included in the study. While MCPA 2-EHE is hydrophobic and it readily adsorbs to surfaces, MCPA acid is more water soluble and has lower affinity to sorption. The amounts of non-extractable radioactive soil residues are very high (43.6% to 98.0%) and it could be an indicator of the soil sorption competing with volatilization. If the above data are not available, the registrant can elect to conduct a new study on end use product of MCPA 2-EHE on both viable and sterilized sandy soil (sand >70% and OM <1.5%; with neutral to acid soil to avoid hydrolysis to MCPA acid) performed parallel at high temperature (40°C) and low soil moisture (moisture 15% of 1/3 bar) for 45 days with first measurements after 24 and 48 hrs.

**PC Code:** 030564  
**Final EPA**  
**Reviewer:** Iwona L. Maher  
Chemist

**Signature:** IWONA MAHER  
**Date:** 5/08/2018

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Date: 2018.05.08 16:44:46  
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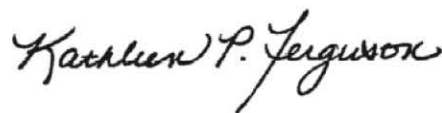
**CDM/CSS-**  
**Dynamac JV**  
**Reviewers:** Richard Lester  
Environmental Scientist

**Signature:**   
**Date:** 1/26/18

Kathleen Ferguson  
Environmental Scientist

Signature:

Date: 1/26/18



*This Data Evaluation Record may have been altered by the Environmental Fate and Effects Division subsequent to signing by CDM/CSS-Dynamac JV personnel. The CDM/CSS-Dynamac Joint Venture role does not include establishing Agency policies.*

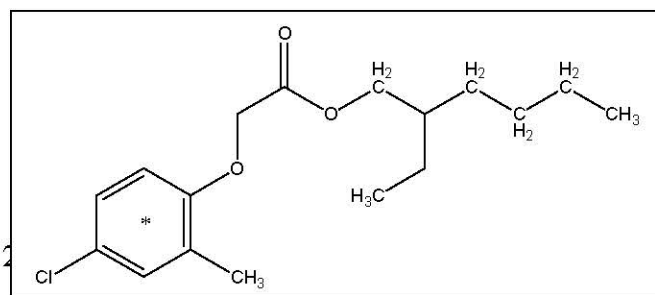
## Executive Summary

In a laboratory study, the volatility of [phenyl- $^{14}\text{C}$ ]MCPA 2-EHE was investigated on sandy loam soil (MSL-PF; pH 6.4) from North Dakota under aerobic conditions at one flow rate (300 mL/minute), two temperatures ( $25 \pm 2^\circ\text{C}$  and  $40 \pm 2^\circ\text{C}$ ), and two soil moisture conditions ( $25 \pm 5\%$  and  $75 \pm 5\%$  of field moisture capacity) for a period of 30 days. The soil was treated at the maximum label rate of 1.5 lbs. a.i./acre (1,680 g a.i./ha). MCPA 2-EHE was applied onto the surface of soil in Erlenmeyer flasks; two flasks were prepared for each treatment. Volatilized gases were continually passed through a polyurethane foam plug and then through a 2N KOH trap. The volatile traps were collected from each treatment at each sampling interval, the entire test systems (traps plus soil) were collected at 30 days.

Minimal to no volatilization of organic compounds was observed during the study. In the definitive experiments, the maximum observed air concentrations of organic volatiles at  $25^\circ\text{C}$  were  $0.3 \mu\text{g}/\text{m}^3$  and  $0.0 \mu\text{g}/\text{m}^3$  at soil moisture conditions of 25% and 75%, respectively. The maximum observed air concentration of total organic volatiles at  $40^\circ\text{C}$  were  $0.5 \mu\text{g}/\text{m}^3$  and  $0.6 \mu\text{g}/\text{m}^3$  at soil moisture conditions of 25% and 75%, respectively. Maximum observed volatilization rates occurred during the first sampling period (0 to 5 days after application). The maximum estimated volatilization rates of organic volatiles were  $7.72 \times 10^{-5} \mu\text{g}/\text{cm}^2\text{-hr}$  ( $25^\circ\text{C}$ , 25% soil moisture),  $0.0 \mu\text{g}/\text{cm}^2\text{-hr}$  ( $25^\circ\text{C}$ , 75% soil moisture),  $14.9 \times 10^{-5} \mu\text{g}/\text{cm}^2\text{-hr}$  ( $40^\circ\text{C}$ , 25% soil moisture), and  $17.3 \times 10^{-5} \mu\text{g}/\text{cm}^2\text{-hr}$  ( $40^\circ\text{C}$ , 75% soil moisture).

$\text{CO}_2$  totaled a maximum of 0.2% at  $25^\circ\text{C}/25\%$  moisture, 0.3% at  $40^\circ\text{C}/25\%$  moisture, 21.7% at  $25^\circ\text{C}/75\%$ , and 26.7% at  $40^\circ\text{C}/75\%$ . In the soil, nearly 100% of the radioactivity was identified as MCPA acid at 30 days posttreatment.

The test system was adequate to trap the parent and its transformation products with mass balances accounting for 96.2 to 103.9% of the applied  $^{14}\text{C}$  activity. The duration of the experiment was adequate to evaluate air concentrations of the parent and transformation products.



## I. Material and Methods

### A. Materials

#### 1. Test Material

**Table 1. Properties of Test Material**

| Property                       | Value   |
|--------------------------------|---|
| Product Name                   | [Phenyl-U- <sup>14</sup> C]MCPA-EHE   |
| Formulation Type               | Solution in acetonitrile  |
| Typical end-use product?       | Not reported  |
| Contaminants and/or impurities | 99.3% chemical purity; No residual solvents detected; Impurities not reported |
| Manufacture #                  | Not reported  |
| Lot #                          | 9459ITH001-3  |
| Type of radiolabel             | <sup>14</sup> C   |
| Specific radioactivity         | 27.36 mCi/mmol<br>87.2 µCi/mg   |
| Radiochemical purity           | 97.1% HPLC  |
| CAS #                          | 29450-45-1  |
| Chemical structure             | See image above<br>* Denotes position of <sup>14</sup> C-radiolabel           |
| Storage stability              | Not reported  |
| pH                             | Not reported  |

Data obtained from p. 12 and Appendix B, p. 58 of the study report.

#### 2. Storage Conditions

The test material was received on May 3, 2016 and stored at ≤10°C (p. 12). The definitive volatility trials occurred between November 30 to December 30, 2016 and January 4 to February 3, 2017 (Tables 10-13, pp. 30-33).

#### 3. Soil

**Table 2. Soil(s) Collection, Storage and Properties**

| Property                                     | Value  |   |
|--|--|---|
|  | Preliminary Test                                       | Definitive Test                             |
| Geographic location                          | Grand Forks County, North Dakota                       | Grand Forks County, North Dakota            |
| Pesticide use history at the collection site | Pesticide free area                                    | Pesticide free area                         |
| Collection date                              | May 2016 based on date of soil characterization report | November 3, 2016                            |
| Collection procedures                        | Sieved through 2 mm mesh                               | Sieved through 2 mm mesh                    |
| Sampling depth                               | 0 to 6 inches  | 0 to 6 inches                               |
| Storage conditions                           | Stored at <i>ca.</i> 4°C prior to the study            | Stored at <i>ca.</i> 4°C prior to the study |
| Storage duration                             | Less than three months                                 | Less than three months                      |

| Property   | Value            |                  |
|--|------------------|------------------|
|  | Preliminary Test | Definitive Test  |
| Soil preparation   |                  |                  |
| Soil texture (USDA <sup>1</sup> ):                         | Sandy Loam       | Sandy Loam       |
| % Sand   | 70               | 67               |
| % Silt   | 14               | 16               |
| % Clay   | 16               | 17               |
| pH (1:1 soil:water)  | 6.8              | 6.8              |
| pH (1:2 soil:0.01M CaCl <sub>2</sub> )                     | 6.3              | 6.4              |
| Organic carbon (%)<br>[Walkley-Black and Loss on Ignition] | 1.8              | 1.9              |
| Organic matter (%)<br>[Walkley-Black and Loss on Ignition] | 3.7              | 3.3              |
| CEC (meq/100 g)<br>[Method not reported]                   | 15.8             | 16.4             |
| Soil Moisture Content (%):                                 |                  |                  |
| At 0.1 bar (pF 2.0)  | 37.7             | 36.8             |
| At 1/3 bar (pF 2.5)  | 22.1             | 25.8             |
| Bulk density (g/cm <sup>3</sup> )                          | 1.06             | 1.06             |
| Microbial biomass (ppm):                                   | 266              | Range of 193-289 |
| Soil taxonomic classification (WRB)                        | Not reported     | Not reported     |

Data obtained from p. 14; Table 1, p. 21; Appendix B, pp. 43 and 56; and Appendix C, pp. 62-65 of the study report.

## B. Study Design

### 1. Experimental Conditions

The volatility chambers used in the study were 500-mL Erlenmeyer flasks fitted with a stopper and equipped with two polyurethane foam plugs outside the flask (p. 14). Air-flow was controlled by vacuum and monitored by a flow meter at the inlet of the volatilization chamber. Temperature was controlled by performing the study in environmental chambers. Temperature was continuously monitored using a Rees temperature monitoring system. It was not stated how the soil moisture was maintained.

**Table 3. Experimental Design**

| Parameter                                       | Description  |
|---|--|
| Duration of the test (days)                     | 30   |
| Soil condition (Air dried/fresh)                | Sieved with a 2-mm mesh and adjusted to soil moisture of 25% or 75% of 1/3 bar |
| Soil sample weight (g/replicate)                | ca. 60   |
| Soil depth (cm)                                 | 1  |
| Test concentration (mg ai/kg soil (dry weight)) | Not reported   |
| Field Equivalent Application Rate (lb a.i./A)   | 1.5  |
| Number of replicates                            | 2  |
| Test apparatus                                  | Volatility chambers composed of 500-mL   |

<sup>1</sup> U.S. Department of Agriculture

| Parameter   |                                      | Description   |
|---|--------------------------------------|---|
|   |                                      | Erlenmeyer flasks fitted with rubber stopper and equipped with two polyurethane foam plugs.                                     |
| Test material application   | Test solution volume used/ treatment | 500 $\mu$ L   |
|   | Application method                   | 500- $\mu$ L Hamilton syringe in a slow circular motion   |
| Indication of test material adsorbing to walls of test apparatus? |                                      | Yes – with attempted spray application.<br>No – with syringe application.   |
| Experimental conditions   | Temperature ( $^{\circ}$ C)          | 25 $\pm$ 2 $^{\circ}$ C and 40 $\pm$ 2 $^{\circ}$ C   |
|   | Relative humidity                    | Not reported  |
|   | Soil moisture content                | 25 $\pm$ 5% and 75 $\pm$ 5%   |
|   | Moisture maintenance method          | Preliminary evaluation determined relative humidity of air drawn through the system necessary to maintain desired soil moisture |
|   | Air flow through system              | 300 mL/min  |
| Continuous darkness (Yes/No):                                     |                                      | Yes, except when environmental chambers were in use   |
| Other observations (if applicable)                                |                                      |   |

Data obtained from pp. 14, 17-18, 20, Tables 10-13, pp. 30-33, and Appendix A, p. 46 of the study report.

## 2. Sampling during Study Period

Off-gases from the volatility chamber were passed through polyurethane foam plugs and then through 2N KOH traps (p. 11). During the definitive testing, the foam plugs were extracted immediately after removal and analyzed by LSC (p. 18). Soil samples from Day 0 and Day 30 were extracted, diluted, and analyzed by HPLC.

**Table 4. Sampling Design**

| Parameter                                | Description   |
|--|---|
| <b>Air Sampling</b>                      |   |
| Sample intervals (days)                  | 25 $^{\circ}$ C testing – Days 5, 10, 15, 19, 22, and 30<br>40 $^{\circ}$ C testing – Days 5, 9, 14, 19, 26, and 30 |
| Sampling method                          | Polyurethane foam plugs and 2N KOH traps  |
| Desired air flow of sampler (mL/min)     | 300   |
| Sample storage before analysis (Yes/No)? | No  |
| <b>Soil Sampling</b>                     |   |
| Sample intervals                         | Days 0 and 30   |
| Sampling method                          | Soil was immediately extracted at the end of each run   |
| Sample storage before analysis (Yes/No)? | No  |

Data obtained from pp. 15, 17-18, and Appendix A, p. 46 of the study report.

## 3. Sample Handling and Storage Stability

Method verification testing involved extracting foam plugs and soil samples within 24 hours of sampling and storage of extracts for seven days before analysis (pp. 15, 18). Stability analyses demonstrated recovery of greater than 98% of spiked samples demonstrating stability of the

extracts at seven days. During the definitive volatilization tests, all foam plugs were extracted immediately after removal from the volatility chamber (p. 18). Foam plug and KOH trap extractions were analyzed immediately after sampling and were stored at *ca.* -20°C (p. 15). The study protocol indicates that soil extracts were also extracted and analyzed immediately (Appendix A, p. 46). No corrections were made to account for instability.

#### 4. Analytical Procedures

**Extraction methods:** Polyurethane foam plugs were placed in a 20-mL scintillation vial and extracted three times with 10 mL acetonitrile by compressing the plug inside the vial with a 2-mL volumetric flask (p. 16). The solvent was removed with a transfer pipette, and the extracts were analyzed by LSC. Extraction efficiency was verified by spiking duplicate samples with three levels of MCPA 2-EHE (pp. 18-19). Recoveries from the spiked samples ranged from 90.86 to 98.12%.

Soil samples were transferred to a Nalgene bottle with 100 mL of acetonitrile (pp. 15-16). Soil was manually broken up, and the bottles were shaken for 60 minutes. Extracts were centrifuged and the supernatant was decanted into a mixing cylinder. The extraction was performed a total of three times. The extracts were then combined and extraction solvent was added to achieve the final volume. The soil extract concentrate was analyzed by HPLC. Extraction efficiency from soil was verified with duplicate samples of soil spiked with three levels of MCPA 2-EHE (p. 18). Recoveries ranged from 99.18 to 103.91%.

**Total Radioactivity Measurement:** Total  $^{14}\text{C}$  residues were determined by summing the percent of applied mass found in the foam plugs, KOH traps, and soil (p. 19 and Tables 6-9, pp. 26-29). Extracts from foam plugs were analyzed by LSC to quantify total  $^{14}\text{C}$ -activity (p. 16). KOH traps were subsampled and analyzed by LSC (p. 18 and Appendix A, p. 47). Soil extracts were analyzed by HPLC analysis with a UV detector and radiochemical flow detector (p. 16).

**Identification and Quantification of Parent Compound:** Aliquots of the sorbent extracts were analyzed for  $^{14}\text{C}$ -activity by LSC (p. 16). Residues in the polyurethane foam plugs were not identified.

The soil extracts were analyzed by HPLC using a Luna C-18 column eluted with a gradient mobile phase of A) 0.1% trifluoroacetic acid in water and B) 0.1% trifluoroacetic acid in acetonitrile, with UV and radioflow detection (p. 16).

**Detection Limits (LOD, LOQ) for the Parent Compound:** A limit of detection and limit of quantitation was not reported for MCPA 2-EHE.

**Detection Limits (LOD, LOQ) for the Transformation Products:** Limits of detection and limits of quantitation were not reported for transformation products.

**Instrument performance:** No information is provided on methods used for instrument calibration.



**Lab recovery, air sampling sorbent material:** All laboratory spike recoveries for polyurethane foam plugs during method verification were within the acceptable range with overall recoveries from duplicate samples spiked with three levels of MCPA 2-EHE between 90.86 and 98.12% (pp. 18-19 and Table 4, p. 24).

**Lab recovery, soils:** All laboratory spike recoveries for soil samples during method verification were within the acceptable range with overall recoveries from duplicate samples spiked with three levels of MCPA 2-EHE between 99.18 and 103.91% (p. 18 and Table 2, p. 22).

**Breakthrough, air samples:** Method verification demonstrated that the polyurethane foam plugs were successful in maintaining MCPA 2-EHE. No breakthrough occurred when foam plugs were spiked with three levels of MCPA 2-EHE within the range expected for the volatility test (p. 19).

## II. Results and Discussion

### A. Data

Sample durations, sample volume flowrates, and the mass of organic volatiles and CO<sub>2</sub> collected on the sorbent material and in KOH traps are shown in **Tables 5 through 8**. Air concentrations were derived by first dividing the observed disintegrations per minute (dpm) via LSC by the specific activity of diluted test material (in dpm/μg) and then dividing the resulting mass by the sample volume (Tables 10-13, pp. 30-33). Air concentrations for organic volatiles ranged from 0.0 μg/m<sup>3</sup> to 0.6 μg/m<sup>3</sup> in individual replicate samples.

### B. Material Balance

The material balance and the distribution of radioactivity in the air and soil samples are shown in **Tables 5 through 8**. Recoveries ranged from 96.2 to 103.9% of the applied radioactivity (%AR; Tables 6-9, pp. 26-29). Non-extractable radioactivity in soil ranged from 43.6 to 98.0% of the applied <sup>14</sup>C-activity (p. 20). No substantial loss of radioactivity by sorption to glassware was observed after the application method was changed from a spray method to syringe application in the preliminary tests (p. 19). The mass balance meets guideline criteria.

### C. Study Conditions

Soil moisture and temperature were maintained throughout the study (pp. 14 and 17). Microbial biomass was not maintained throughout the study.

### D. Transformation Products

Concentrations of organic volatiles in air range from non-detect to very low (reported as 0.0 to 0.6 μg/m<sup>3</sup>). The study does not specifically quantify air concentrations for MCPA 2-EHE and organic transformation products. CO<sub>2</sub> was observed in the KOH traps as confirmed by



precipitation with  $\text{BaCl}_2$  to form  $\text{Ba}^{14}\text{CO}_3$  (p. 11).  $^{14}\text{CO}_2$ -activity ranged from 0.1 to 26.7% of the applied radioactivity (Tables 6-9, pp. 26-29).

HPLC analysis of soil extracts showed that the majority of radioactivity (97 to 100%) of the MCPA 2-EHE was converted to MCPA Acid during the 30 day study (pp. 19-20). No other significant  $^{14}\text{C}$ -labeled compounds were detected.

#### **E. Volatilization**

Rates of volatilization (*e.g.*, flux) for organic volatiles are provided in **Tables 5 through 8**. Volatile losses ( $\mu\text{g}$ ) were estimated by dividing the observed disintegrations per minute (dpm) by LSC by the specific activity of diluted test material (dpm/ $\mu\text{g}$ ; Tables 10-13, pp. 30-33). Volatilization flux rates ( $\mu\text{g}/\text{cm}^2/\text{hr}$ ) were estimated by dividing the volatile losses by the product of the soil area ( $\text{cm}^2$ ) and the length of the sampling interval (hrs). Volatilization rates for organic volatiles were very low. The maximum volatilization rate for organic volatiles was  $1.73 \times 10^{-4} \mu\text{g}/\text{cm}^2/\text{hr}$  for an individual replicate ( $9.89 \times 10^{-5}$  averaged over two replicates) for the first sampling period at  $40^\circ\text{C}$  and 75% soil moisture (Table 13, p. 33). Organic volatiles were not detected in 38 of 48 samples.

**Table 5. Volatility of MCPA 2-EHE from soil at 25°C and 25% soil moisture**

| Period  |                             | 1                          |          | 2        |          | 3        |          | 4        |          | 5        |          | 6        |          | Total |       |
|---|-----------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|-------|
| Days After Treatment                                |                             | 5                          |          | 10       |          | 15       |          | 19       |          | 22       |          | 30       |          |       |       |
| Replicate   |                             | 1                          | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1     | 2     |
| Air Concentration Analyses                          |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Sample Duration (hours)                             |                             | 119.22                     | 119.22   | 120.85   | 120.85   | 118.50   | 118.50   | 96.48    | 96.48    | 71.05    | 71.05    | 191.62   | 191.62   |       |       |
| Sample Volume (m³)                                  |                             | 2.146                      | 2.146    | 2.175    | 2.175    | 2.133    | 2.133    | 1.737    | 1.737    | 1.279    | 1.279    | 3.449    | 3.449    |       |       |
| Organic Volatiles                                   | Collected mass (µg)         | 0.0                        | 0.6      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      |       |       |
|   | Air concentration (µg/m³)   | 0.0                        | 0.3      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      |       |       |
|   | Volatility (µg/cm²-hr)      | 0.00E+00                   | 7.72E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |       |       |
|   | % of applied radioactivity¹ | 0.0                        | 0.06     | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0   | 0.06  |
| ¹⁴CO₂   | % of applied radioactivity² | 0.0                        | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.1      | 0.2      | 0.1   | 0.2   |
| Soil Analyses                                       |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Total extractable                                   |                             | Soil concentration (µg/kg) |          |          |          |          |          |          |          |          |          | NR       | NR       |       |       |
|   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 11.3     | 11.7     | 11.3  | 11.7  |
| Unextracted residues                                |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 91.4     | 90.6     | 91.4  | 90.6  |
| Total   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 102.7    | 102.3    | 102.7 | 102.3 |
| Material Balance                                    |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Total material balance (% of applied radioactivity) |                             |                            |          |          |          |          |          |          |          |          |          |          |          | 102.8 | 102.5 |

Data obtained from Table 6, p. 26 and Table 10, p. 30 of the study report.

NR indicates not reported.

<sup>1</sup>Percent of applied radioactivity for organic volatiles calculated by reviewer as [Length of sampling interval (hrs)] × [<sup>14</sup>C-residue volatilization rate (% applied radioactivity/hr)] based on data from Table 10, p. 30 of the study report.

<sup>2</sup>Percent of applied radioactivity for <sup>14</sup>CO<sub>2</sub> for each sample period is back calculated from the cumulative totals presented in Table 6, p. 26 of the study report.

**Table 6. Volatility of MCPA 2-EHE from soil at 25°C and 75% soil moisture**

| Period  |                             | 1                          |          | 2        |          | 3        |          | 4        |          | 5        |          | 6        |          | Total |      |
|---|-----------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|------|
| Days After Treatment                                |                             | 5                          |          | 10       |          | 15       |          | 19       |          | 22       |          | 30       |          |       |      |
| Replicate   |                             | 1                          | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1     | 2    |
| Air Concentration Analyses                          |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Sample Duration (hours)                             |                             | 119.22                     | 119.22   | 120.85   | 120.85   | 118.50   | 118.50   | 96.48    | 96.48    | 71.05    | 71.05    | 191.62   | 191.62   |       |      |
| Sample Volume (m³)                                  |                             | 2.146                      | 2.146    | 2.175    | 2.175    | 2.133    | 2.133    | 1.737    | 1.737    | 1.279    | 1.279    | 3.449    | 3.449    |       |      |
| Organic Volatiles                                   | Collected mass (µg)         | 0.0                        | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      |       |      |
|   | Air concentration (µg/m³)   | 0.0                        | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      |       |      |
|   | Volatility (µg/cm²-hr)      | 0.00E+00                   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |       |      |
|   | % of applied radioactivity¹ | 0.0                        | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0   | 0.0  |
| ¹⁴CO₂   | % of applied radioactivity² | 2.5                        | 0.3      | 4.8      | 2.6      | 4.4      | 1.7      | 3.2      | 1.6      | 2.0      | 0.9      | 4.8      | 2.3      | 21.7  | 9.4  |
| Soil Analyses                                       |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Total extractable                                   |                             | Soil concentration (µg/kg) |          |          |          |          |          |          |          |          |          | NR       | NR       |       |      |
|   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 18.5     | 23.6     | 18.5  | 23.6 |
| Unextracted residues                                |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 60.4     | 66.5     | 60.4  | 66.5 |
| Total   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 78.9     | 90.1     | 78.9  | 90.1 |
| Material Balance                                    |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Total material balance (% of applied radioactivity) |                             |                            |          |          |          |          |          |          |          |          |          |          |          | 100.6 | 99.5 |

Data obtained from Table 7, p. 27 and Table 11, p. 31 of the study report.

NR indicates not reported.

<sup>1</sup>Percent of applied radioactivity for organic volatiles calculated by reviewer as [Length of sampling interval (hrs)] × [<sup>14</sup>C-residue volatilization rate (% applied radioactivity/hr)] based on data from Table 11, p. 31 of the study report.

<sup>2</sup>Percent of applied radioactivity for <sup>14</sup>CO<sub>2</sub> for each sample period is back calculated from the cumulative totals presented in Table 7, p. 27 of the study report.

**Table 7. Volatility of MCPA 2-EHE from soil at 40°C and 25% soil moisture**

| Period  |                             | 1                          |          | 2        |          | 3        |          | 4        |          | 5        |          | 6        |          | Total |       |
|---|-----------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|-------|
| Days After Treatment                                |                             | 5                          |          | 9        |          | 14       |          | 19       |          | 26       |          | 30       |          |       |       |
| Replicate   |                             | 1                          | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1     | 2     |
| Air Concentration Analyses                          |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Sample Duration (hours)                             |                             | 119.25                     | 119.25   | 94.22    | 94.22    | 120.92   | 120.92   | 118.83   | 118.83   | 166.10   | 166.10   | 94.43    | 94.43    |       |       |
| Sample Volume (m³)                                  |                             | 2.147                      | 2.147    | 1.696    | 1.696    | 2.177    | 2.177    | 2.139    | 2.139    | 2.990    | 2.990    | 1.700    | 1.700    |       |       |
| Organic Volatiles                                   | Collected mass (µg)         | 1.1                        | 0.3      | 0.3      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.2      | 0.0      | 0.2      | 0.0      |       |       |
|   | Air concentration (µg/m³)   | 0.5                        | 0.2      | 0.2      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.1      | 0.0      | 0.1      | 0.0      |       |       |
|   | Volatility (µg/cm²-hr)      | 1.49E-04                   | 4.29E-05 | 4.88E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.62E-05 | 0.00E+00 | 3.65E-05 | 0.00E+00 |       |       |
|   | % of applied radioactivity¹ | 0.11                       | 0.03     | 0.03     | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.02     | 0.0      | 0.02     | 0.0      | 0.17  | 0.03  |
| ¹⁴CO₂   | % of applied radioactivity² | 0.0                        | 0.0      | 0.0      | 0.0      | 0.1      | 0.1      | 0.0      | 0.1      | 0.1      | 0.1      | 0.0      | 0.0      | 0.2   | 0.3   |
| Soil Analyses                                       |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Total extractable                                   |                             | Soil concentration (µg/kg) |          |          |          |          |          |          |          |          |          | NR       | NR       |       |       |
|   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 4.2      | 9.4      | 4.2   | 9.4   |
| Unextracted residues                                |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 98.0     | 94.3     | 98.0  | 94.3  |
| Total   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 102.2    | 103.7    | 102.2 | 103.7 |
| Material Balance                                    |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |       |
| Total material balance (% of applied radioactivity) |                             |                            |          |          |          |          |          |          |          |          |          |          |          | 102.5 | 103.9 |

Data obtained from Table 8, p. 28 and Table 12, p. 32 of the study report.

NR indicates not reported.

<sup>1</sup>Percent of applied radioactivity for organic volatiles calculated by reviewer as [Length of sampling interval (hrs)] × [<sup>14</sup>C-residue volatilization rate (% applied radioactivity/hr)] based on data from Table 12, p. 32 of the study report.

<sup>2</sup>Percent of applied radioactivity for <sup>14</sup>CO<sub>2</sub> for each sample period is back calculated from the cumulative totals presented in Table 8, p. 28 of the study report.

**Table 8. Volatility of MCPA 2-EHE from soil at 40°C and 75% soil moisture**

| Period  |                             | 1                          |          | 2        |          | 3        |          | 4        |          | 5        |          | 6        |          | Total |      |
|---|-----------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|------|
| Days After Treatment                                |                             | 5                          |          | 9        |          | 14       |          | 19       |          | 26       |          | 30       |          |       |      |
| Replicate   |                             | 1                          | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1        | 2        | 1     | 2    |
| Air Concentration Analyses                          |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Sample Duration (hours)                             |                             | 119.25                     | 119.25   | 94.22    | 94.22    | 120.92   | 120.92   | 118.83   | 118.83   | 166.10   | 166.10   | 94.43    | 94.43    |       |      |
| Sample Volume (m³)                                  |                             | 2.147                      | 2.147    | 1.696    | 1.696    | 2.177    | 2.177    | 2.139    | 2.139    | 2.990    | 2.990    | 1.700    | 1.700    |       |      |
| Organic Volatiles                                   | Collected mass (µg)         | 1.3                        | 0.2      | 0.0      | 0.0      | 0.0      | 0.0      | 0.2      | 0.0      | 0.0      | 0.0      | 0.0      | 0.7      |       |      |
|   | Air concentration (µg/m³)   | 0.6                        | 0.1      | 0.0      | 0.0      | 0.0      | 0.0      | 0.1      | 0.0      | 0.0      | 0.0      | 0.0      | 0.4      |       |      |
|   | Volatility (µg/cm²-hr)      | 1.73E-04                   | 2.47E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.58E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.11E-04 |       |      |
|   | % of applied radioactivity¹ | 0.13                       | 0.02     | 0.00     | 0.00     | 0.00     | 0.00     | 0.02     | 0.00     | 0.00     | 0.00     | 0.00     | 0.06     | 0.14  | 0.08 |
| ¹⁴CO₂   | % of applied radioactivity² | 0.1                        | 1.3      | 0.0      | 2.3      | 1.1      | 4.3      | 0.2      | 5.0      | 0.3      | 8.8      | 0.1      | 5.0      | 1.8   | 26.7 |
| Soil Analyses                                       |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Total extractable                                   |                             | Soil concentration (µg/kg) |          |          |          |          |          |          |          |          |          | NR       | NR       |       |      |
|   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 10.1     | 25.8     | 10.1  | 25.8 |
| Unextracted residues                                |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 88.1     | 43.6     | 88.1  | 43.6 |
| Total   |                             | % of applied radioactivity |          |          |          |          |          |          |          |          |          | 98.2     | 69.4     | 98.2  | 69.4 |
| Material Balance                                    |                             |                            |          |          |          |          |          |          |          |          |          |          |          |       |      |
| Total material balance (% of applied radioactivity) |                             |                            |          |          |          |          |          |          |          |          |          |          |          | 100.2 | 96.2 |

Data obtained from Table 9, p. 29 and Table 13, p. 33 of the study report.

NR indicates not reported.

<sup>1</sup>Percent of applied radioactivity for organic volatiles calculated by reviewer as [Length of sampling interval (hrs)] × [<sup>14</sup>C-residue volatilization rate (% applied radioactivity/hr)] based on data from Table 13, p. 33 of the study report.

<sup>2</sup>Percent of applied radioactivity for <sup>14</sup>CO<sub>2</sub> for each sample period is back calculated from the cumulative totals presented in Table 9, p. 29 of the study report.

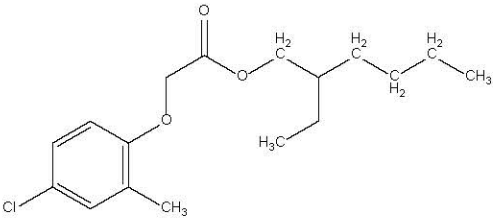
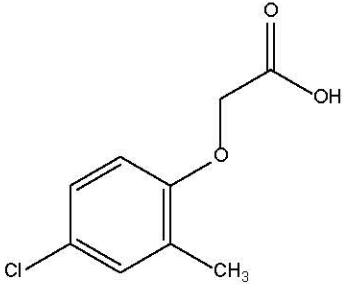
### III. Study Deficiencies and Reviewer's Comments

1. Because low or no organic volatiles were collected in many sampling periods, no measurable volatilization rate for MCPA 2-EHE was reported. The study quantified only total organic volatiles measured by LSC, and then stored at temperature -20°C. The protocol indicated that extracts would be analyzed by HPLC (Appendix A, p. 47).
2. Limits of detection and limits of quantitation for the methods used in the study are not reported.
3. The study protocol indicates that soil moisture was maintained by determining the relative humidity of air drawn through the system necessary to maintain the desired soil moisture content (Appendix A, p. 46).
4. No information is provided on methods used for instrument calibration.
5. The storage stability of test materials was not reported.
6. The test material was stored at a temperature  $\leq 10^{\circ}\text{C}$  (p. 12) while the study protocol indicated storage should be at temperatures less than -15°C (Appendix A, p. 41).

### IV. References

United States Environmental Protection Agency (U.S. EPA). October 2008. Office of Chemical Safety and Pollution Prevention (OCSPP). Fate, Transport, and Transformation Test Guidelines, OPPTS 835.1410, Laboratory Volatility, EPA 712-C-08-011, 4 p. EPA, Washington, D.C.

DER ATTACHMENT 1. MCPA 2-EHE and Its Environmental Transformation Products. <sup>A</sup>

| Code Name/<br>Synonym                                      | Chemical Name  | Chemical Structure  | Study<br>Type                 | MRID     | Maximum<br>%AR (day) | Final %AR<br>(study length) |
|--|--|---|-------------------------------|----------|----------------------|-----------------------------|
| <b>PARENT</b>  |  |   |                               |          |                      |                             |
| <b>MCPA 2-EHE<br/>(MCPA 2-ethyl<br/>hexyl ester)</b>       | <b>IUPAC:</b> (RS)-2-ethylhexyl 4-chloro-o-tolyloxyacetate<br><b>CAS:</b> 2-Ethylhexyl 2-(4-chloro-2-methylphenoxy)acetate<br><b>CAS No.:</b> 29450-45-1<br><b>Formula:</b> C <sub>17</sub> H <sub>25</sub> ClO <sub>3</sub><br><b>MW:</b> 312.83 g/mol<br><b>SMILES:</b><br><chem>CC1=C(OCC(OCC(CC)CCCC)=O)C=CC(Cl)=C1</chem> |   | 835.1410<br>Lab<br>volatility | 50295201 | PRT                  | PRT                         |
| <b>MAJOR (&gt;10%) TRANSFORMATION PRODUCTS</b>             |  |   |                               |          |                      |                             |
| <b>MCPA acid<br/>(MCPA)</b>                                | <b>IUPAC:</b> 4-Chloro-o-tolyloxyacetic acid<br><b>CAS:</b> 2-(4-Chloro-2-methylphenoxy)acetic acid<br><b>CAS No.:</b> 94-74-6<br><b>Formula:</b> C <sub>9</sub> H <sub>9</sub> ClO <sub>3</sub><br><b>MW:</b> 200.62 g/mol<br><b>SMILES:</b><br><chem>O=C(O)COc(c(cc1Cl)C)c1</chem>   |  | 835.1410<br>Lab<br>volatility | 50295201 | NA                   | NA                          |
| <b>MINOR (&lt;10%) TRANSFORMATION PRODUCTS</b>             |  |   |                               |          |                      |                             |
| No minor transformation products were identified.          |  |   |                               |          |                      |                             |
| <b>REFERENCE COMPOUNDS NOT IDENTIFIED</b>                  |  |   |                               |          |                      |                             |
| All compounds used as reference compounds were identified. |  |   |                               |          |                      |                             |

<sup>A</sup> AR means "applied radioactivity". MW means "molecular weight". PRT means "parent". NA means "not applicable".





